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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No.:	7,393,001	Examiner:	John Olszewski
Inventors:	Rott et al.	Art Unit:	3618
Serial No.:	10/524,328	Confirm. No.:	6933
Filing Date:	August 10, 2005	Docket No.:	1093-126 PCT/US
Title:	A MULTILAYER FILM FOR CONSTRUCTING SKIS	Dated:	July 15, 2008

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SUBMISSION UNDER 37 C.F.R. 1.501(a)

Sir:

The Patent Owner has become aware of the following references that were cited in an Office Action issued by the Japanese Patent Office on June 8, 2008 in a patent application corresponding to the application that issued as the above-captioned patent.

FOREIGN PATENT DOCUMENTS

<u>COUNTRY</u>	<u>PUBLICATION NO.</u>	<u>PUBLICATION DATE</u>
Japan	10-230563	September 2, 1998
Japan	2000-262184	September 26, 2000

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JUL 24 2008

Technology Center 3600

Patent No. 7,393,001
Application Serial No. 10/524,328
Submission Under 37 C.F.R. 1.501

Docket No.: 1093-126 PCT/US

The above-referenced documents are listed on Form PTO-1449 and copies of the references and patent abstracts are enclosed to facilitate reference to them.

If the Examiner has any questions or comments relating to the cited references, he is respectfully invited to contact the patent owner's attorney at the telephone number set forth below.

Respectfully submitted,

A handwritten signature in black ink, reading "Kevin E. McDermott". The signature is fluid and cursive, with a long horizontal stroke at the end.

Kevin E. McDermott
Registration No.: 35,946
Attorney for Patent Owner

HOFFMANN & BARON, LLP
6900 Jericho Turnpike
Syosset, New York 11791
(516) 822-3550

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FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE
(Rev. 2-32) PATENT AND TRADEMARK OFFICE

ATTY. DOCKET NO.
1093-126 PCT/US

SERIAL NO.
10/524,328

INFORMATION DISCLOSURE
STATEMENT BY APPLICANT

APPLICANT
John Olszewski

CONFIRMATION NO.
6933

FILING DATE
August 10, 2005

GROUP
3618

(Use several sheets if necessary)

U.S. Patent No. 7,393,001

U.S. PATENT PUBLICATIONS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUB CLASS	TRANSLATION	
							YES	NO
		10-230563	9-2-1998	Japan				
		2000-262184	9-26-2000	Japan				

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

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EXAMINER

DATE CONSIDERED

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication with applicant.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-230563

(43)Date of publication of application : 02.09.1998

(51)Int.Cl.

B32B 15/08

B05D 1/38

G02B 5/28

(21)Application number : 09-034743

(71)Applicant : TOSHIN:KK
MIZUNO CORP.

(22)Date of filing : 19.02.1997

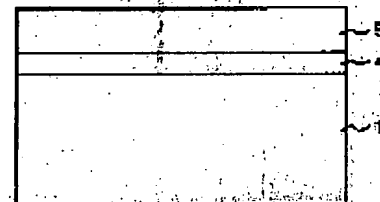
(72)Inventor : WATANABE TOMOYOSHI
MIZUNO YOSHICHIKA
DATE TETSUYA

(54) INTERFERENCE COLOR ARTICLE AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To form a decorative layer which is thin in wall thickness and emits chromatic color in a short time even for a long article by a method wherein an interference film consisting of an oxide is formed on an article surface, and the decorative layer composed of a laminated light transmitting synthetic resin film is formed thereon.

SOLUTION: An oxide interference film 4 and a top coat layer 5 are successively laminated on a surface of an article body 1. At first, a long article is fitted to a rotor in a vacuum container, which is rotated and revolved. Then, a voltage is applied directly to an interference film formed material to execute reactive sputtering, and the oxide interference film of a specific film thickness is formed on a surface of a non-decorative article. A definite chromatic color of good reproducibility is obtained by forming such the interference film. Further, only by adjusting a film thickness, an optional interference color is colored. Further, when a metal reflective film is applied to a grounding, the same color is obtained with an about one third film thickness of that in the case where not applied. Furthermore, when the film thickness is controlled, a gradation effect appears on the long article.



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 S9 1 PN=JP 10230563 (S) PC=JP A

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Dialog eLink Order File History

9/35/1

DIALOG(R)File 345: Inpadoc/Fam.& Legal Stat

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55593418 Family ID: 25593419

<No. of Patents: 1> <No. of Countries: 1>

Patent Basic (No, Kind, Date): JP 10230563 A 19980902

INTERFERENCE COLOR ARTICLE AND ITS MANUFACTURE (English)

Patent Assignee: TOSHIN KK; MIZUNO KK

Author (Inventor): WATANABE TOMOYOSHI; MIZUNO YOSHICHIKA; DATE TETSUYA

Patent Family:

Patent No	Kd Date	Applic No	Kd Date	Wk Added
JP 10230563	A 19980902	JP 199734743	A 19970219	199839 (B)

Priority Data (No, Kind, Date):

JP 199734743 A 19970219

***** JAPAN (JP) *****

JAPAN (JP) PATENT (S):

Patent (No, Kind, Date): JP 10230563 A 19980902

INTERFERENCE COLOR ARTICLE AND ITS MANUFACTURE (English)

Patent Assignee: TOSHIN KK; MIZUNO KK

Author (Inventor): WATANABE TOMOYOSHI; MIZUNO YOSHICHIKA; DATE TETSUYA

Priority (No, Kind, Date): JP 199734743 A 19970219

Applic (No, Kind, Date): JP 199734743 A 19970219

IPC + Level Value Position Status Version Action Source Office

v. 6 main: B32B-015/08

v. 6 : B05D-001/38

v. 6 : G02B-005/28

v. 8 adv : B05D-0001/38 A I L R 20060101 20051220 M JP

v. 8 adv : B32B-0015/08 A I L R 20060101 20051220 M JP

v. 8 adv : G02B-0005/28 A I F R 20060101 20051220 M JP

v. 8 core: B05D-0001/38 C I L R 20060101 20051220 M JP

v. 8 core: B32B-0015/08 C I L R 20060101 20051220 M JP

v. 8 core: G02B-0005/28 C I F R 20060101 20051220 M JP

Date of Availability: 19980902 Unexamined printed without grant

Language of Document: Japanese

Update Week: Backfile (First Week Added: 199839)

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-230563

(43) 公開日 平成10年(1998) 9月2日

(51) Int.Cl.[°]

識別記号

F I

B 3 2 B 15/08

B 3 2 B 15/08

D

B 0 5 D 1/38

B 0 5 D 1/38

G 0 2 B 5/28

G 0 2 B 5/28

審査請求 未請求 請求項の数4 QL (全 5 頁)

(21) 出願番号 特願平9-34743

(22) 出願日 平成9年(1997) 2月19日

(71) 出願人 597023260

株式会社トーシン

大阪府藤井寺市川北3丁目8番19号

(71) 出願人 000005935

美津濃株式会社

大阪府大阪市中央区北浜4丁目1番23号

(72) 発明者 渡辺 朋美

大阪府大阪市住之江区南港北1丁目12番35号 美津濃株式会社内

(72) 発明者 水野 吉近

岐阜県養老郡養老町高田3877-8 美津濃株式会社養老工場内

(74) 代理人 弁理士 青山 葆 (外1名)

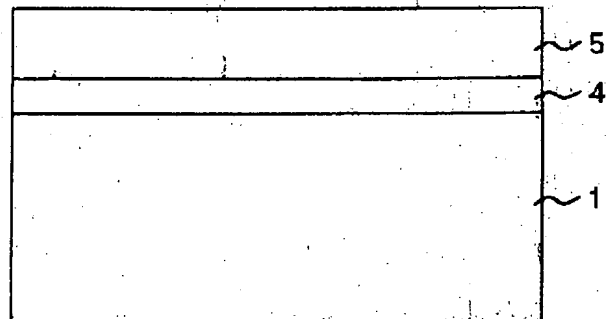
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(54) 【発明の名称】 干渉色物品及びその製造方法

(57) 【要約】

【課題】 物品に鮮やかな有彩色で外観装飾を任意に行うことができ、かつ、ゴルフシャフト等の長尺物品であっても短時間に、かつ、肉厚が薄くて鮮やかな有彩色を発する装飾層を形成すること。

【解決手段】 物品表面に酸化物からなる干渉膜を形成し、その表面に積層された光透過性合成樹脂膜からなる装飾層を形成する。



【特許請求の範囲】

【請求項 1】 表面に酸化物からなる干渉膜と、その表面に積層された光透過性合成樹脂からなる保護層を有する干渉色物品。

【請求項 2】 前記干渉膜が物品本体の表面に形成された金属反射膜の表面上に積層されている請求項 1 に記載の干渉色物品。

【請求項 3】 前記物品本体と金属反射膜との間に合成樹脂製アンダーコート層を有する干渉色物品。

【請求項 4】 物品本体の表面に合成樹脂塗料を用いてアンダーコートを形成し、その表面に金属薄膜を形成した後、スパッタリングにより酸化物干渉膜を積層し、その干渉膜の表面を合成樹脂塗料で透明なトップコート層を形成することを特徴とする干渉色物品の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は干渉色物品及びその製造方法、特に、ゴルフシャフトやスキースtockなどのスポーツ用品その他の物品の表面上に光の干渉を利用した鮮やかな有彩色を発する装飾層を有する物品に関するものである。

【0002】

【従来の技術】 従来、ゴルフシャフトやスキースtock等のスポーツ用品或は釣り竿、ルアー等のレジャー用品などの物品は、表面保護或は装飾の手段として塗装膜や金属メッキなどが形成されている。例えば、ゴルフシャフトでは、従来はスプレーガンでの吹き付けによる着色塗装や金属粉を混ぜたメタリック塗装等で外観装飾を施した製品が市販されている。

【0003】

【発明が解決しようとする課題】 しかしながら、従来の吹き付け塗装やメタリック塗装等の塗装膜では、任意の色に着色したり金属色を付与することはできるが、鮮やかな有彩色を発する外観装飾を付与することは不可能であり、所望の色彩を付与するためには重ね塗りを必要とし、必然的に重量増加を招くため、ゴルフシャフトや釣り竿等のように微妙な重量バランスが要求されると同時に、より一段と軽量化が要求される長尺物品には満足な結果を得ることは困難であった。

【0004】 他方、装飾膜の薄膜化を図るため、真空蒸着法、スパッタリング法等を採用することが考えられる。しかしながら、前者の真空蒸着法は、特に光学レンズの反射防止膜の製作等に使用されているが、これをゴルフシャフト等の長い棒状の物品に適用しようとする、真空蒸着法では物質の蒸発が点蒸発になるため、膜厚分布が余弦法則に従って球面状に分布することから、長尺物品の表面に均一な膜を形成させることは困難である。

【0005】 これに対して、後者のスパッタリング法は、真空中で薄膜形成材料からなるターゲットにイオン

等を衝突させてターゲットの構成原子や分子を弾き飛ばし、ターゲットに相対する基板表面に様に付着させることができるため、長いターゲットを使用すれば長尺物品表面にも均一に干渉膜を付けることができ、しかも、制御が容易で再現性も良いという利点がある。しかしながら、この方法は、膜形成速度が遅いため生産性に欠け、しかも、長時間スパッタリングすると基板表面が加熱されるため、プラスチック製物品に適用するとダメージを与えるという問題がある。

【0006】 従って、本発明は、物品に鮮やかな有彩色で外観装飾を任意に行うことができ、かつ、ゴルフシャフト等の長尺物品であっても短時間に、かつ、肉厚が薄くて鮮やかな有彩色を発する装飾層を形成することができるようにすることを目的とするものである。

【0007】

【課題を解決するための手段】 本発明は、薄膜がその両面からの多重反射による干渉のため着色して見え、しかも、その色が膜の厚さにのみ依存することに着目し、前記課題を解決する手段として、基本的には、物品表面に酸化物からなる干渉膜を形成し、その表面に積層された光透過性合成樹脂膜からなる装飾層を形成するようにしたものである。

【0008】 前記干渉膜は、好ましい形態として、物品本体の表面に形成された金属反射膜の表面上に積層される。このようにすると、同じ有彩色をより薄肉の干渉膜で実現でき、しかも、装飾層による重量増加を抑制することができる。

【0009】 前記物品の本体が樹脂のみで形成されていない場合、例えば、硝子繊維強化プラスチック、炭素繊維強化プラスチックなど繊維強化プラスチック製である場合、物品本体と金属反射膜との間に合成樹脂製アンダーコート層を形成するのが好ましい。このアンダーコート層を形成することにより、金属反射膜を形成する表面を平滑にすると共に、真空中での物品表面からのガス放出を減少させ、金属反射膜との密着性を向上させることができる。

【0010】 前記干渉膜の形成材料としては、代表的なものとしてアルミニウム、チタン、クロム、ステンレス等が挙げられるが、後述の反射膜形成材料と同じものを使用するのが好ましい。この干渉膜の厚さは、所望の有彩色に応じて変化するため一義的に定めることはできないが、一般的には 10～3000 μm の範囲内で決定される。この干渉膜の厚さは、スパッタリング時間及び又はターゲットへの印加電圧を変えることにより、任意に調整することができ、それによって赤色から紫色まで多段階の有彩色を実現できる。

【0011】 また、前記反射膜の形成材料としては、反射率の高い金属材料であれば任意のものを使用できる。代表的なものとしては、銀、クロム、ニッケル、アルミニウム、チタンなどが挙げられるが、物品の機械的強度

を高める観点からアルミニウムよりもチタン、クロム、ステンレス等がより効果的である。

【0012】前記アンダーコート層及びトップコート層は、スプレーコーティング、フローコーティング、シゴキコーティングなど公知の塗装方法を採用すれば良い。前記アンダーコート層材料としては、エポキシ樹脂、ウレタン樹脂、メラミン樹脂、セルロース樹脂、ポリアミド樹脂、ブチラール樹脂、フタル酸等のアルキド樹脂、シリコン樹脂、シリコンアクリル樹脂、アクリル樹脂など、従来公知のプラスチック素材の蒸着膜形成のベースコートに汎用されている任意のものを使用すれば良い。

【0013】これらの樹脂の特性としては、ベースコートタイプの下地密着性に優れ、金属反射膜を形成する金属の蒸着を助け、金属反射膜の保持ができる金属との親和力の高い樹脂であること及び常温硬化可能タイプであることが好ましい。具体的には、Tg 100℃以下で比較的柔らかいもの、例えばポーラスな硬化膜を形成し、且つ分散性を確保する程度にスリップ剤を少量添加したものを使用すれば良い。なお、好ましくは、ポリエステルポリオール系樹脂のものが良い。

【0014】又、トップコート層の材料としては、光の干渉を生じさせるためには透明又は半透明でなければならないので、ウレタン樹脂、セルロース樹脂、メタクリル酸樹脂、メチル樹脂、アクリロニトリル樹脂、ブタジエンスチレン共重合樹脂、アクリロニトリルースチレン共重合樹脂、フタル酸等のアルキド樹脂、アクリル樹脂、シリコン樹脂、シリコンアクリル樹脂等が挙げられる。なお、トップコートは膜厚によって干渉、偏光が屈折率により素地と異なる発色を示すため、20 μm程度に押さえる必要がある。

【0015】又、これらの樹脂の特徴として、ポーラスな金属反射膜表面を貫通し、下地塗料と直接手を結ぶことにより、密着性を確保したり、金属反射膜と直接反応し、密着性を確保することが挙げられる。なお、これらの特性を有する塗料としては、アクリルウレタン系のアクリル樹脂が望ましい。なお、Tg 100℃以上の比較的硬度の高い塗料では、スプレーコーティング、フローコーティング、シゴキコーティングなどの公知の塗装方法を採用出来るものである。

【0016】前記干渉色物品は、本発明によれば、物品の表面に合成樹脂塗料を用いてアンダーコートを形成し、その表面に金属薄膜を形成した後、スパッタリングにより酸化物干渉膜を積層し、その干渉膜の表面に合成樹脂塗料で透明なトップコート層を形成することにより製造できる。

【0017】前記金属反射膜は、真空蒸着法あるいはスパッタリング法によって形成するのが好ましい。特に、金属反射膜の形成手段としてスパッタリング法を採用すると、スパッタリング雰囲気为非酸化性雰囲気から酸化性雰囲気に変更するだけで金属反射膜の形成に続いて干

渉膜の形成を行うことができる。また、金属反射膜を形成させることにより、下地に金属反射膜のない場合に比べ、同じ有彩色をより薄い干渉膜で達成でき、スパッタリング時間の短縮を図ることができる。例えば、金属反射膜としてチタン膜を形成した場合、チタン膜の無い場合の約1/3の干渉膜の膜厚で鮮やかな有彩色を得ることができる。

【0018】

【発明の実施の形態】以下、本発明の実施例を図面に基づいて説明する。図1は本発明の一実施例を示し、この干渉色物品は物品本体1の表面に酸化物干渉膜4及びトップコート層5を順次積層した構造を有している。また、図2は本発明の他の実施例を示し、物品本体1の表面にアンダーコート2、金属反射層3、酸化物干渉膜4及びトップコート層5を順次積層した構造を有している。

【0019】図1に示す構造の干渉色物品は、例えば、図3に示す構造の装置を用いて製造できる。図3に示す装置は、真空容器11と、その内部に配設され非装飾物品を自転及び公転させる回転機構12と、真空容器11の外部に配設され前記回転機構を回転駆動する駆動モータ13と、干渉膜形成材料からなるターゲットを保持するターゲット保持手段14と、前記真空容器11にそれぞれバルブを介して接続された雰囲気ガス供給源15及び酸素供給源16とを備え、真空容器11はその排気口17を介して図示しない真空ポンプに接続されている。なお、18は覗き窓である。

【0020】前記装置を用いて図1の干渉色物品を製造するに際しては、まず、真空容器11内の回転体12内に長尺物品20を取り付け、排気口17を介して真空ポンプにより真空容器11内の圧力を $10^{-4} \sim 10^{-6}$ Torrに排気したのち駆動モータ13を回転させ、長尺物品を自転及び公転させる。

【0021】次いで、酸素供給源16から少量の酸素を真空容器11内に導入した後、雰囲気ガス供給源15からアルゴンガスを導入して真空容器内の圧力を $10^{-3} \sim 10^{-4}$ Torrに調整し、ターゲット14、14'に直流電圧を印加して反応性スパッタリングを行ない、非装飾物品の表面に所定膜厚の酸化物干渉膜を形成した後、真空容器内を大気圧に戻し、非装飾物品を取り出してトップコートを形成すれば良い。なお、金属反射膜の形成方法として蒸着法を採用する場合、図3に示すように、タングステンボード19の上にクロム・ステンレス等の金属反射膜形成材料を載せて加熱することにより、又はタングステンフィラメント等により加熱して蒸着させ、蒸着するようにしても良い。

【0022】

【実施例1】図1の装置を用い、非装飾物品として複数本のカーボン繊維強化プラスチック製ゴルフシャフト20を真空容器11内の回転体12内に取付け、チタンタ

ターゲット14を取り付けた後、排気口17より真空ポンプで真空容器11内の圧力を 7×10^{-6} Torrに真空排気した後、駆動モータ13によりゴルフシャフト20を自転及び公転させ、その真空容器内に酸素供給源16から酸素ガスを導入して真空容器内の圧力を 4×10^{-4} Torrに調整し、更に雰囲気ガス供給源15からアルゴンガスを導入して真空容器内の圧力を 3×10^{-3} Torrに調整した。

【0023】チタンターゲット14に直流電圧を印加して45分間スパッタリングを行った後、真空容器内を大気圧に戻し、ゴルフシャフト20を取り出し試料とした。この試料は、紫がかったピンク色の干渉色を発し、その表面の干渉膜はチタン酸化物からなり、膜厚は約1200 Åであった。この干渉膜の上にアクリル樹脂をコーティングして製品とした。

【0024】

【実施例2】実施例1と同様に真空容器内の回転体にゴルフシャフトを取付け、真空ポンプにより真空容器内の圧力を 7×10^{-6} Torrに排気した後、駆動モータを回転させ、ゴルフシャフトを自転公転させる。真空容器内にアルゴンガスを導入し、真空容器内の圧力を 3×10^{-3} Torrに調整した。チタンのターゲットに直流電圧を印加し、5分間スパッタリングを行ない、チタンの金属反射膜を形成した。

【0025】次に、真空排気して真空容器内の圧力を再び 10^{-6} Torrに排気した後、酸素ガスを導入して真空容器内の圧力を 4×10^{-4} Torrに調整し、更にアルゴンガスを導入して、真空容器内の圧力を 3×10^{-3} Torrに調整した後、チタンターゲットに直流電圧を印加し、チタン酸化物のスパッタリングを行ないながら、30 視窓18より真空容器内のゴルフシャフトの色が紫がかったピンク色をした時を確認し、スパッタリングを止め*

*た。スパッタリング時間は15分間であった。真空容器内を大気圧に戻し、ゴルフシャフト20を取り出して試料とした。また、この干渉膜の上にアクリル樹脂をコーティングして製品とした。

【0026】この試料は、紫がかったピンク色の干渉色を発し、その表面の干渉膜はチタン酸化物からなり、その膜厚を測定したところ約400 Åであった。

【0027】

【発明の効果】本発明によれば、干渉膜を形成することにより従来得られなかった再現性の良い鮮やかな有彩色を得ることができ、しかも、膜厚を調整するだけで任意の干渉色を発色させることができ、また、下地に金属反射膜を施すことにより施さない場合の干渉膜の膜厚の約三分の一の厚さで同色を得ることができ、従って、スパッタリング方の欠点である膜形成速度の遅い点を補い、生産性を向上させることができる。更に、チタンターゲットへの印加電圧を変えることにより、チタン酸化物の膜厚をコントロールし、長尺物品の左右で干渉色の色を変えるグラデーション効果を出すこともできる。

【図面の簡単な説明】

【図1】 本発明の一実施例を示す干渉色物品の断面図。

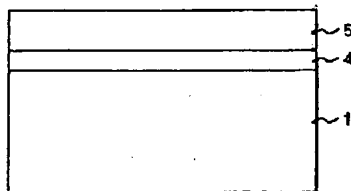
【図2】 本発明の他の実施例を示す干渉色物品の断面図。

【図3】 本発明に係る干渉色物品を製造するための装置の概略構成図。

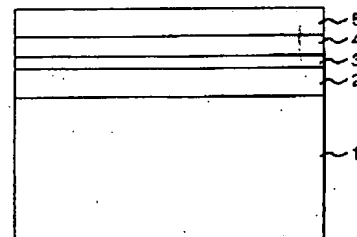
【符号の説明】

- 1： 物品本体
- 2： アンダーコート
- 3： 金属反射層
- 4： 酸化物干渉膜
- 5： トップコート層

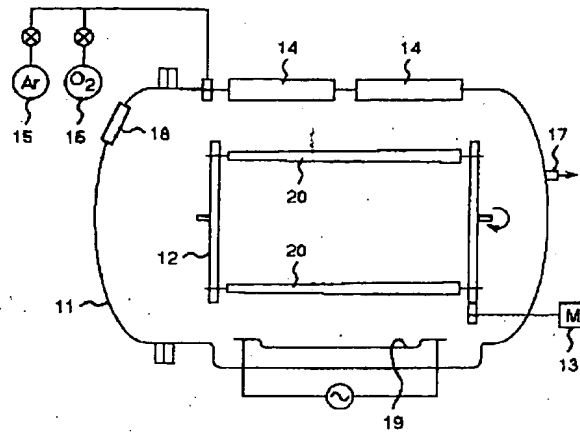
【図1】



【図2】



【図3】



フロントページの続き

(72)発明者 伊達 哲也
大阪府藤井寺市川北3丁目8番19号 株式
会社トーシン内

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CLAIMS

[Claim(s)]

[Claim 1] An interference color article comprising:

An interference film which becomes the surface from an oxide.

A protective layer which consists of a light transmittance state synthetic resin laminated by the surface.

[Claim 2] The interference color article according to claim 1 in which said interference film is laminated on the surface of a metal reflection film formed in the surface of a main part of an article.

[Claim 3] An interference color article which has an undercoat layer made of a synthetic resin between said main part of an article, and a metal reflection film.

[Claim 4] A manufacturing method of an interference color article laminating an oxide interference film by sputtering and forming a transparent topcoat layer for the surface of the interference film with synthetic coating material after using synthetic coating material for the surface of a main part of an article, forming an under coat and forming a metal thin film in the surface.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the article which has a decoration layer which emits an interference color article and a manufacturing method for the same, and the vivid chromatic color that used interference of light on the surface of sporting goods and other articles, such as a golf shaft and skipole, especially.

[0002]

[Description of the Prior Art] Conventionally, as for articles, such as leisure goods, such as sporting goods, such as a golf shaft and skipole, or a fishing rod, and lure, a coating film, metal plating, etc. are formed as a means of a surface protection or an ornament. For example, in the golf shaft, the product which gave the appearance ornament by the metallic coating etc. which mixed the color coating and the metal powder by spraying in the spray gun is marketed conventionally.

[0003]

[Problem(s) to be Solved by the Invention] However, although it can be colored arbitrary colors or a metal color can be given in coating films, such as the conventional spray painting and metallic coating, In order it is impossible to give the appearance ornament which emits a vivid chromatic color, to need two coats in order to give desired color, and to cause a weight increment inevitably, While delicate weight balance was required like the golf shaft or the fishing rod, it was difficult for the long article as which a weight saving is required much more to obtain a satisfactory result.

[0004] On the other hand, since thin film-ization of an ornament film is attained, it is possible to adopt a vacuum deposition method, sputtering process, etc. However, although especially the former vacuum deposition method is used for manufacture of the antireflection film of an optical lens etc., Since evaporation of a substance will turn into point evaporation in a vacuum deposition method if it is going to apply this to a cylindrical article with a long golf shaft etc. and thickness distribution is distributed over sphere form according to a cosine law, it is difficult to make a uniform film form in the surface of a long

article.

[0005]On the other hand, the latter sputtering process makes ion etc. collide with the target which consists of thin-film-forming material in a vacuum, and flips the composition atom and molecule of a target off. Since it can be made to adhere to the substrate face which faces a target uniformly, if a long target is used, an interference film can be uniformly attached also to a long article surface, and, moreover, there is an advantage that control is easy and reproducibility is also good. However, since this method has a slow film formation speed, productivity is missing, and since a substrate face will moreover be heated if prolonged sputtering is carried out, when it applies to the article made from a plastic, there is a problem of giving a damage.

[0006]therefore -- even if this invention can perform an appearance ornament on articles arbitrarily with a vivid chromatic color and are long articles, such as a golf shaft, -- a short time -- and it aims at enabling it to form the decoration layer which emits a chromatic color thin thickness and vivid.

[0007]

[Means for Solving the Problem]As for this invention, a thin film colors for interference by a multiple echo from the both sides, appears, and, moreover, as a means to solve said technical problem, paying attention to the color being dependent only on membranous thickness fundamentally, An interference film which consists of oxides is formed in an article surface, and a decoration layer which consists of light transmittance state synthetic resin membrane laminated by the surface is formed.

[0008]Said interference film is laminated as a desirable gestalt on the surface of a metal reflection film formed in the surface of a main part of an article. If it does in this way, an interference film of thin meat can realize the same chromatic color more, and, moreover, a weight increment by a decoration layer can be controlled.

[0009]When a main part of said article is not formed only by resin, for example it is products made from fiber reinforced plastics, such as glass fiber strengthening plastics and carbon fiber strengthening plastics, it is preferred to form an undercoat layer made of a synthetic resin between a main part of an article and a metal reflection film. The surface which forms a metal reflection film by forming this undercoat layer is made smooth, and a gas evolution from an article surface in inside of a vacuum can be decreased, and adhesion with a metal reflection film can be raised.

[0010]Although aluminum, titanium, chromium, stainless steel, etc. are mentioned as a typical thing as a formation material of said interference film, it is preferred to use the same thing as the below-mentioned reflection film formation material. Since thickness of this interference film changes according to a desired chromatic color, it cannot be defined uniquely, but it is generally determined within the limits of 10-3000 micrometers. By changing impressed electromotive force to sputtering time and -, or a target, thickness of this interference film can be adjusted arbitrarily and can realize a chromatic color of a multi stage story from red to purple by it.

[0011]As a formation material of said reflection film, if it is a metallic material with high reflectance, arbitrary things can be used. As a typical thing, although silver, chromium, nickel, aluminum, titanium, etc. are mentioned, titanium, chromium, stainless steel, etc. are more effective than a viewpoint of raising a mechanical strength of an article to aluminum.

[0012]Publicly known coating methods, such as spray coating, flow coating, and cover-printing coating, should just be used for said undercoat layer and a topcoat layer. As said undercoat layer material, an epoxy resin, urethane resin, What is necessary is just to use arbitrary things currently used widely in a base coat of vacuum evaporation film formation of conventionally publicly known plastic materials, such as alkyd resin, such as melamine resin, cellulosic resin, polyamide resin, butyral resin, and phthalic acid, silicon resin, a silicon acrylic resin, and an acrylic resin.

[0013]It is preferred that they are that it is resin with high affinity with metal which is excellent in base coat type ground adhesion, helps vacuum evaporation of metal which forms a metal reflection film as the characteristic of these resin, and can perform maintenance of a metal reflection film, and a room-temperature-setting possible type. What is necessary is just to use what added a small amount of slipping agents to such an extent that a comparatively soft thing, for example, a PORASU hardening layer, is formed at less than $T_g 100^{\circ}\text{C}$ and dispersibility is specifically secured. A thing of polyester polyol system resin is good preferably.

[0014]Since it must be transparent or translucent as a material of a topcoat layer in order to produce interference of light, Alkyd resin, such as urethane resin, cellulosic resin, methacrylate resin, methyl resin, acrylonitrile resin, butadiene styrene copolymerization resin, acrylonitrile styrene copolymerization resin, and phthalic acid, an acrylic resin, silicon resin, a silicon acrylic resin, etc. are mentioned. In order for interference and polarization to show coloring which differs from a base with a refractive index by thickness, it is necessary to press down topcoat to about 20 micrometers.

[0015]By penetrating the PORASU metal reflection film surface as a feature of these resin, and connecting a hand to a sealer directly, adhesion is secured, or a direct reaction is carried out to a metal reflection film, and securing adhesion is mentioned. As a paint which has these characteristics, an acrylic resin of an acrylic urethane system is desirable. In a paint with comparatively high hardness beyond $T_g 100^{\circ}\text{C}$, publicly known coating methods, such as spray coating, flow coating, and cover-printing coating, are employable.

[0016]According to this invention, after synthetic coating material is used for said interference color article on the surface of an article, it forms an under coat and forms a metal thin film in the surface, it laminates an oxide interference film by sputtering, and can manufacture the surface of the interference film by forming a transparent topcoat layer with synthetic coating material.

[0017]As for said metal reflection film, it is preferred to form by vacuum deposition method or sputtering process. If sputtering process is especially adopted as means forming of a metal reflection film, an interference film can be formed following formation of a metal

reflection film only by changing sputtering atmosphere into an oxidizing atmosphere from a non-oxidizing atmosphere. By making a metal reflection film form, compared with a case where there is no metal reflection film in a ground, a thinner interference film can attain the same chromatic color, and shortening of sputtering time can be aimed at. For example, when a titanium film is formed as a metal reflection film, a vivid chromatic color can be obtained by thickness of an interference film of the abbreviation $1/3$ in case there is no titanium film.

[0018]

[Embodiment of the Invention] Hereafter, the example of this invention is described based on a drawing. Drawing 1 shows one example of this invention, and this interference color article has the structure which laminated the oxide interference film 4 and the topcoat layer 5 one by one on the surface of the main part 1 of an article. Drawing 2 shows other examples of this invention, and has the structure which laminated the under coat 2, the metallic reflective layer 3, the oxide interference film 4, and the topcoat layer 5 one by one on the surface of the main part 1 of an article.

[0019] The interference color article of the structure shown in drawing 1 can be manufactured using the device of the structure shown in drawing 3, for example. The rolling mechanism 12 to which the device shown in drawing 3 is allocated in by the vacuum housing 11 and its inside, and makes a non-enrichment article rotate and revolve around the sun, The drive motor 13 which is allocated in the exterior of the vacuum housing 11 and rotates said rolling mechanism, It has a target holding means 14 to hold the target which consists of an interference film formation material, and the atmosphere gas supply source 15 and the oxygen supply 16 which were connected to said vacuum housing 11 via the valve, respectively, and the vacuum housing 11 is connected to the vacuum pump which is not illustrated via the exhaust port 17. 18 is an inspection hole.

[0020] It faces manufacturing the interference color article of drawing 1 using said device, First, the long article 20 is attached in the solid of revolution 12 in the vacuum housing 11, after exhausting the pressure in the vacuum housing 11 to 10^{-6} - 10^{-6} Torr with a vacuum pump via the exhaust port 17, the drive motor 13 is rotated, and a long article is made to rotate and revolve around the sun.

[0021] Subsequently, after introducing a small amount of oxygen in the vacuum housing 11 from the oxygen supply 16, Introduce argon gas from the atmosphere gas supply source 15, and the pressure in a vacuum housing is adjusted to 10^{-3} - 10^{-4} Torr, What is necessary is to return the inside of a vacuum housing to atmospheric pressure, to take out a non-enrichment article, and just to form topcoat, after impressing direct current voltage in the targets 14 and 14, performing reactive sputtering and forming the oxide interference film of predetermined thickness in the surface of a non-enrichment article. as it is alike and is shown in drawing 3 when adopting vacuum deposition as a formation method of a metal reflection film, Heat by carrying and heating metal reflection film formation materials, such

as chromium stainless steel, on the tungsten board 19, or a tungsten filament, and it is made to evaporate, and may be made to vapor-deposit.

[0022]

[Example 1] Two or more golf shafts 20 made from carbon fiber reinforced plastics are attached in the solid of revolution 12 in the vacuum housing 11 as a non-enrichment article using the device of drawing 1. After attaching the titanium target 14 and carrying out evacuation of the pressure in the vacuum housing 11 to 7×10^{-6} Torr with a vacuum pump from the exhaust port 17, Make the golf shaft 20 rotate and revolve around the sun with the drive motor 13, introduce oxygen gas from the oxygen supply 16 in the vacuum housing, and the pressure in a vacuum housing is adjusted to 4×10^{-4} Torr, Argon gas was introduced from the atmosphere gas supply source 15, and the pressure in a vacuum housing was adjusted to 3×10^{-3} Torr.

[0023] After impressing direct current voltage to the titanium target 14 and performing sputtering for 45 minutes, the inside of a vacuum housing was returned to atmospheric pressure, the golf shaft 20 was taken out, and it was considered as the sample. This sample emitted the interference color of the purplish pink, the interference film of that surface consisted of titanium oxide, and thickness was about 1200Å. The acrylic resin was coated on this interference film, and it was considered as the product.

[0024]

[Example 2] After attaching a golf shaft to the solid of revolution in a vacuum housing like Example 1 and exhausting the pressure in a vacuum housing to 7×10^{-6} Torr with a vacuum pump, a drive motor is rotated and rotation revolution of the golf shaft is carried out. Argon gas was introduced in the vacuum housing and the pressure in a vacuum housing was adjusted to 3×10^{-3} Torr. Direct current voltage was impressed to the target of titanium, sputtering was performed for 5 minutes, and the metal reflection film of titanium was formed.

[0025] Next, after carrying out evacuation and exhausting the pressure in a vacuum housing to 10^{-6} Torr again, introduce oxygen gas, and adjust the pressure in a vacuum housing to 4×10^{-4} Torr, and also argon gas is introduced. After adjusting the pressure in a vacuum housing to 3×10^{-3} Torr, having impressed direct current voltage to the titanium target, and performing sputtering of titanium oxide, from the sight glass 18, the time of carrying out pink in which the color of the golf shaft in a vacuum housing was purplish was checked, and sputtering was stopped. Sputtering time was for 15 minutes. The inside of a vacuum housing was returned to atmospheric pressure, the golf shaft 20 was taken out, and it was considered as the sample. The acrylic resin was coated on this interference film, and it was considered as the product.

[0026] When this sample emitted the interference color of the purplish pink, the interference film of that surface consisted of titanium oxide and that thickness was measured, it was

about 400Å.

[0027]

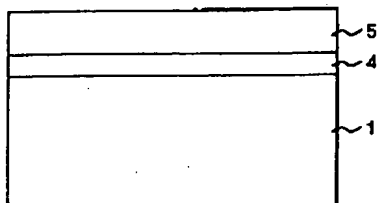
[Effect of the Invention]An interference film is formed in this invention.

Therefore, the good vivid chromatic color of the reproducibility which was not acquired conventionally can be obtained, And arbitrary interference colors can be made to color only by adjusting thickness, The same color can be obtained by the thickness of about 1/3 of the thickness of the interference film when not giving by giving a metal reflection film to a ground, therefore the point that the film formation speed which is a fault of the method of sputtering is slow is compensated, productivity is raised, and things are made.

By changing the impressed electromotive force to a titanium target, the thickness of titanium oxide can be controlled and the gradation effect of changing the color of an interference color by the right and left of a long article can also be taken out.

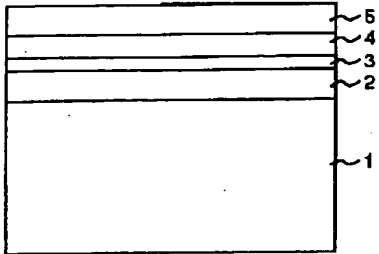
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Drawing selection Drawing 1



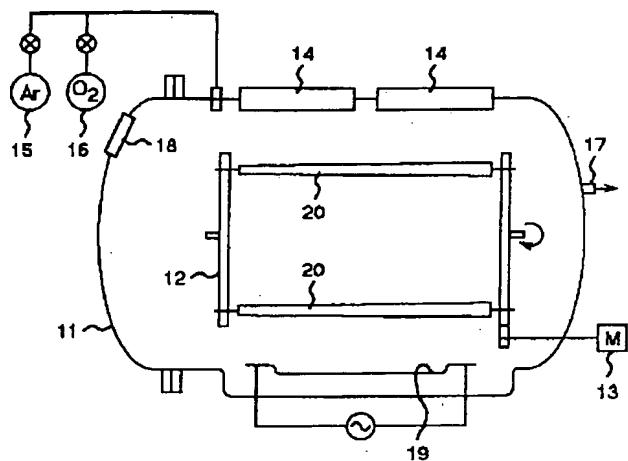
[Translation done.]

Drawing selection Drawing 2



[Translation done.]

Drawing selection Drawing 3



[Translation done.]

Ref. A

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-262184

(43)Date of publication of application : 26.09.2000

(51)Int.Cl.

A01K 87/00

A63B 53/10

B44C 3/02

(21)Application number : 11-070163

(71)Applicant : DAIWA SEIKO INC

(22)Date of filing : 16.03.1999

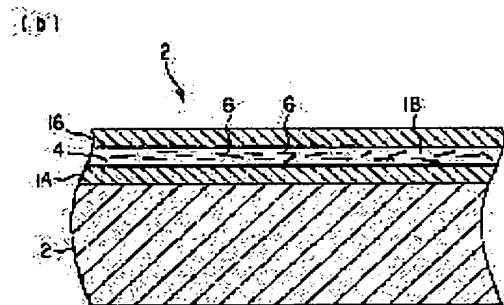
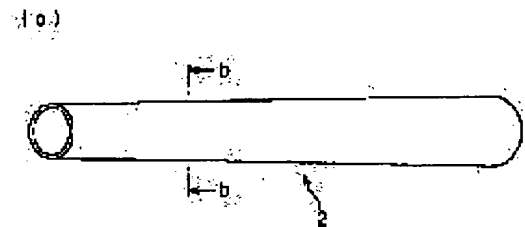
(72)Inventor : TSURUFUJI TOMOYOSHI

(54) SPORTING GOODS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide lightweight sporting goods capable of keeping a definite appearance over a long period and excellent in endurance.

SOLUTION: These sport goods are equipped with a member body 2, a transparent decorative layer 4 formed on the outside of the member body 2 and a structural coloring body 6 mixed in the decorative layer 4 and exhibiting structural coloring and the structural coloring body is formed by superposing a plurality of layers of thin films which are colorless and transparent and relatively different in refractive indices of light.



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CLAIMS

[Claim(s)]

[Claim 1]Sporting goods, wherein it has a member body, a decoration layer of the shape of transparence formed in the outside of this member body, and structure chromogen that were mixed in this decoration layer and that carries out structure coloring, and structure chromogen piles up a two or more layers thin film in which it is transparence-like and rates of optical refraction differ relatively and is formed.

[Claim 2]The sporting goods according to claim 1, wherein said member body is formed by fiber reinforced plastics and a decoration layer and said structure chromogen of the shape of said transparence are formed with a synthetic resin material, respectively.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to sporting goods, such as a fishing rod, a reel, lure, **** for fishing, a cooler box, a golf club, a tennis racket, a skiing board, and skipole, for example.

[0002]

[Description of the Prior Art]In the nature upon which daylight shines directly, various kinds of sporting goods which were mentioned above are used. Conventionally, coating treatment is performed to the outside surface of these sporting goods by the paint which mixed metal particles at the time of coating treatment, and the coat to which photoluminescence appearance is made to show is formed in it.

[0003]

[Problem(s) to be Solved by the Invention]However, when long term use was carried out in the nature upon which daylight shines directly, there was a problem that maintaining fixed appearance could not be continued in the conventional sporting goods. There is nothing only by the color of the coat currently formed in the outside surface of sporting goods specifically fading (colour fade-out), and there was a problem in respect of the endurance that the color of a coat will change with oxidation of metal particles, etc., or a coat will exfoliate. Although forming metal plating and a metallic film in the surface is also considered, the new problem that the weight of sporting goods will increase arises.

[0004]This invention is accomplished in order to solve such a problem, and the purpose is to provide lightweight sporting goods excellent in the endurance which it continues at a long period of time, and can continue maintaining fixed appearance.

[0005]

[Means for Solving the Problem]In order to attain such a purpose, sporting goods of this invention, It has a member body, a decoration layer of the shape of transparence formed in the outside of this member body, and structure chromogen that were mixed in this decoration layer and that carries out structure coloring, and structure chromogen piles up a

two or more layers thin film in which it is transparence-like and rates of optical refraction differ relatively, and is formed.

[0006]

[Embodiment of the Invention]Hereafter, the sporting goods of this invention are explained with reference to an accompanying drawing. As sporting goods of this invention, a fishing rod, a reel, lure, **** for fishing, a cooler box, a golf club, a tennis racket, a skiing board, skipole, etc. correspond, for example.

[0007]The sporting goods concerning a 1st embodiment of this invention are shown in drawing 1, and these sporting goods, It has the member body 2, the decoration layer 4 of the shape of transparence formed in the outside of the member body 2, and the structure chromogen 6 that were mixed in the decoration layer 4 and that carries out structure coloring, and the structure chromogen 6 piles up the two or more layers thin films 8 and 10 (refer to drawing 2) in which it is water-white [-like] respectively, and the rates of optical refraction differ relatively, and is formed.

[0008]Although the tubular body member 2 is shown in drawing 1 (a), this shows the tubular part used for various sporting goods which were mentioned above.

[0009]The member body 2 is provided with the main part layer 12 (refer to drawing 1 (b)) formed by, for example, winding two or more prepreg sheets with which synthetic resins, such as an epoxy resin, are impregnated around fibers reinforced, such as glass fiber, carbon fiber, and a boron fiber.

[0010]The foundation layer 14 which comprises resin, such as urethane and epoxy, for example is formed in the outside surface of such a main part layer 12, and the decoration layer 4 of the shape of transparence mentioned above is formed in the outside surface of the foundation layer 14. And the transparence-like protective layer 16 is formed in the outside surface of this decoration layer 4. The term as used herein of "the shape of transparence" means a generic concept including transparence or half-transparence.

[0011]For example, the decoration layer 4 mixed the structure chromogen 6 which carries out structure coloring, it can be formed by painting or printing the paints 18, such as epoxy and urethane, on the outside surface of the foundation layer 14. In this case, although it is possible to keep step with one way, and to make it arrange, or to make it arrange in the random direction as for the structure chromogen 6, such array constitution can be arbitrarily changed according to the purpose of use (kind of color which carries out structure coloring). Although the decoration layer 4 can be constituted in a monolayer or two or more layers, the decoration layer 4 which comprises a monolayer is shown in drawing 1 (b) as the example.

[0012]The gestalt of the structure chromogen 6 is shown in drawing 2 and drawing 3. On the whole, the structure chromogen 6 of drawing 2 has constituted particle state. This structure chromogen 6 piles up the two or more layers ultra-thin films 8 and 10 in which it is water-white [-like], and the rates of optical refraction differ relatively, is formed, and specifically, it is constituted so that desired structure coloring (a specific color, two or more

colors, an interference color, etc.) can be issued with the combination of the difference of the rate of optical refraction.

[0013]In this case, as for the number of laminations of the ultra-thin films 8 and 10, it is preferred to set it as five or more (preferably 10-30 layers) layers, and, as for the thickness per layer of the ultra-thin films 8 and 10, it is preferred to set it as 3 micrometers or less (preferably 0.5 micrometer or less). It is preferred to set the thickness of the structure chromogen 6 as 20 micrometers or less (preferably 10 micrometers or less) based on such setups.

[0014]It is good to constitute the structure chromogen 6 in the shape of foil form particles, and for thickness to be a size several micrometers or less at 100 micrometers or less in this case. Or in order to use a thin decoration layer, a size is good for thickness to make it 0.5 micrometer or less by several micrometers or less.

[0015]In such structure chromogen 6, the turn of piling up the ultra-thin films 8 and 10 in which refractive indices differ relatively, combination, etc. can be suitably chosen according to the purpose of use (kind of color which carries out structure coloring). In this case, for example, a gas layer, a liquid layer or a metal layer, etc. may be made to intervene among the laminated ultra-thin films 8 and 10 of two or more layers. The structure chromogen 6 which overlapped the ultra-thin film 8 with a large refractive index and the ultra-thin film 10 with a small refractive index on each other, and formed them as the example is shown in drawing 2.

[0016]With structure coloring, by the shape of water-white, and when the rate of optical refraction irradiates the structure chromogen 6 which piled up the two or more layers relatively different ultra-thin films 8 and 10, and formed them (for example, available light, infrared light, ultraviolet light), When the light of a specified wavelength reflects from each ultra-thin films 8 and 10, the thing of a coloring operation which appears in the structure chromogen 6 surface is meant.

[0017]Although several ultra-thin films 8 and 10 in which refractive indices differ relatively can be formed in such structure chromogen 6, for example using a metallic material or natural material, In order to realize structure chromogen 6 excellent in the endurance which rust etc. do not generate, it is preferred to form two or more ultra-thin films 8 and 10, for example with synthetic resin materials, such as polyester and polyamide.

[0018]In the embodiment shown in drawing 1 (b), when forming the decoration layer 4 in the outside surface of the main part layer 12 directly, without forming the foundation layer 14, it is preferred to process the outside surface of the main part layer 12 into mirror finished surface form so that the decoration layer 4 can be formed uniformly. In this case, as a method of processing the outside surface of the main part layer 12 into mirror finished surface form, it is possible to apply barrel finishing, buffing, etc. for example.

[0019]According to such composition, in the decoration layer 4 inside the protective layer 16, by the shape of water-white and by having arranged the structure chromogen 6 in which the rate of optical refraction put the two or more layers relatively different ultra-thin films 8

and 10, and formed them, and having constituted sporting goods, Lightweight sporting goods excellent in the endurance which it continues at a long period of time, and can continue maintaining fixed appearance can be realized without producing problems which were produced in conventional technology, such as fading (colour fade-out), change of a color, exfoliation. In the coating treatment colored with the color and paints of conventional technology by having used the structure chromogen 6, it becomes possible to also solve the problem of environmental pollution, without a lot of waste fluid's coming out, and producing the problem of needing a lot of water and electrical and electric equipment. [0020]Other structure chromogens 6 are shown in drawing 3. Although this structure chromogen 6 has constituted the long and slender cylindrical gestalt, this structure chromogen 6 does so the same optical effect effect as the structure chromogen 6 (refer to drawing 1 and drawing 2) of a 1st embodiment. The bell-shaped structure chromogen 6 which piled up the two or more layers thin film 20 in which it is water-white [-like], and the rates of optical refraction differ relatively, wound it, and formed it is shown in the figure (a), and to the figure (b). The cylindrical structure chromogen 6 which piled up the two or more layers thin film 20 in which it is water-white [-like], and the rates of optical refraction differ relatively on the periphery of the long and slender cylindrical core material 22, wound it, and formed it is shown.

[0021]It is possible by grinding this structure chromogen 6 finely and arranging like the composition of a 1st embodiment of the above in the decoration layer 4 (refer to drawing 1 and drawing 2) as an operating mode of such long and slender cylindrical structure chromogen 6, to realize the same operation effect as a 1st embodiment of the above. For example, this structure chromogen 6 may be made to loop around the outside surface of sporting goods as another operating mode, using the long and slender cylindrical structure chromogen 6 as it is. When using particle state, several micrometers or less are used and it uses, but when using fibrous and using, in order to attain a thin decoration layer and weight saving, it is good for 100 micrometers or less of diameters to be 10 micrometers or less preferably. Textiles are lengthened and arranged or it is made a prepreg sheet and film state as textile fabrics, and it can loop around one and can also use for the outer layer of a body member.

[0022]According to the composition of drawing 3 (b), it becomes possible to realize the structure coloring effect according to physical properties, the characteristic, etc. of material of the core material 22. In this case, the intensity of the structure chromogen 6 can be raised by using fibers reinforced, such as carbon fiber and glass fiber, as a material of the core material 22.

[0023]A 2nd embodiment of this invention is shown in drawing 4, and the film 24 which can be pasted up on a subject is shown in drawing 4 (a). The film 24 is provided with the substrate film 28 in which the adhesive layer 26 was formed in the undersurface, and the decoration layer 4 by which the structure chromogen 6 applied to the embodiment mentioned above was mixed in the upper surface of the substrate film 28 is formed. And

the transparence-like protective layer 16 is formed in the outside surface of the decoration layer 4.

[0024]As a material of the substrate film 28, it is good to, use the translucency film of pole thickness, such as polyester and PVC, for example. As a material of the adhesive layer 26, materials other than the usual binder, such as a heat cure type binder or adhesives, are applied.

[0025]According to such composition, it becomes possible by sticking the film 24 on the part of a request of sporting goods to carry out structure coloring of the sporting goods selectively. For example, the film 24 can be stuck on the surface of the member body 2 which has the composition shown in drawing 1 as shown in drawing 4 (b). In this case, in order to protect the film 24, it is preferred to coat the whole outside surface of the member body 2 and the film 24 with the protective layer 30.

[0026]It is preferred to stick the film 24 on the positions (for example, the former rod pipe of a fishing rod, the Oguchi part, anterior part, the rear of a grip part, etc.) which do not cause strength reduction as a sticking position of the film 24. If the film 24 is stuck on the blade rod pipe of a fishing rod, a fishing rod becomes unable to carry out and it can also be made to function as a distinguishing mark of quantity.

[0027]The substrate film 28 is formed instead of the protective layer 16, and the substrate film 28 on the adhesive layer 26 may be removed, and the film 24 may be constituted. Since the substrate film 28 which served as the protective layer 16 can be constituted according to such composition, it becomes easy to carry out the thinning of the film 24.

[0028]The sporting goods concerning a 3rd embodiment of this invention are shown in drawing 5. The sporting goods of this 3rd embodiment are improvement of a 1st embodiment mentioned above, and two layers of decoration layers 4 by which the structure chromogen 6 was arranged pile them up, and they are formed. Since other composition is the same as that of a 1st embodiment, it attaches identical codes and omits the explanation.

[0029]In this case, if the structure chromogen 6 in each decoration layer 4 is arranged with one way and arranged as shown in drawing 5 (it arranges to for example, the sporting-goods surface and parallel), a decorative effect (specifically optical operation effect of structure coloring) can be highlighted. When it sees from the protective layer 16 side, it is visible to monochrome.

[0030]In this embodiment, although two layers of decoration layers 4 are piled up as the example, it is not limited to this and may put on three or more layers.

[0031]The sporting goods concerning a 4th embodiment of this invention are shown in drawing 6. The sporting goods of this 4th embodiment are improvement of a 1st embodiment mentioned above, and the structure chromogen 6 in the decoration layer 4 is arranged in the random direction.

[0032]Thus, by arranging the structure chromogen 6 in the random direction, it becomes possible to realize structure coloring of a complicated color. If it sees from the protective

layer 16 side, a plural color can make it the appearance which looks simultaneous.

[0033]The sporting goods concerning a 5th embodiment of this invention are shown in drawing 7. The sporting goods of this 5th embodiment are improvement of a 1st embodiment mentioned above, and are twisted around the surface of the tubular body member 2 at the interval with the line-of-thread objects 32 constant as a pattern layer, such as a fiber reinforced.

[0034]Thus, if the line-of-thread object 32 is twisted, the decoration layer 4 (refer to drawing 1) will be selectively exposed from between these lines-of-thread objects 32, The decorative effect (specifically optical operation effect of structure coloring) according to the combination of the line-of-thread object 32 and the decoration layer 4 can be demonstrated, and it becomes a compound ornament also in appearance and becomes beautiful. It becomes possible by having twisted the line-of-thread object 32 to raise the endurance of the decoration layer 4 further.

[0035]The sporting goods concerning a 6th embodiment of this invention are shown in drawing 8. The sporting goods of this 6th embodiment are improvement of a 1st embodiment mentioned above, and are changing the outside surface of the member body 2 to rugged form. It is uneven on the outside surface of the main part layer 12, and the decoration layer 4 and the protective layer 16 are made to specifically laminate in order via the foundation layer 14 on this rugged form outside surface.

[0036]According to such composition, since the decoration layer 4 can also carry out concavo-convex change according to a concavo-convex change of the main part layer 12 and the foundation layer 14, it becomes possible to give change to the decorative effect (specifically optical operation effect of structure coloring) of the decoration layer 4.

[0037]The sporting goods concerning a 7th embodiment of this invention are shown in drawing 9. The sporting goods of this 7th embodiment are improvement of a 1st embodiment mentioned above, and the coated layer 34 of the shape of transparence which changes from two or more layers to the outside surface of the decoration layer 4 is formed.

[0038]In this case, in order to raise that appearance nature as a material of the coated layer 34, it is good to composite-color-ize or to adjust brightness (brightness of a decoration layer) using the paint of the color which has the transparent feeling which paid the color, for example.

[0039]having formed in the outside surface of the decoration layer 4 the coated layer 34 of the shape of transparence which comprises two or more layers according to such composition -- the decorative effect (specifically optical operation effect of structure coloring) of the decoration layer 4 -- in addition, it becomes still more possible to add change of coloring from coated layer 34 the very thing of two or more layers.

[0040]The sporting goods concerning an 8th embodiment of this invention are shown in drawing 10. The sporting goods of this 8th embodiment are improvement of a 1st embodiment mentioned above, pile up the two or more layers decoration layer 4, and are formed.

[0041]Thus, by piling up the two or more layers decoration layer 4, it becomes possible to demonstrate the decorative effect (specifically optical operation effect of structure coloring) according to the number of layers of the decoration layer 4.

[0042]It is shown in drawing 11, the sporting goods, i.e., the fishing rod, concerning a 9th embodiment of this invention. The various decoration layers 4 applied to the 1st mentioned above - an 8th embodiment are suitably used for the fishing rod of this 9th embodiment selectively.

[0043]As the one example of use, in each of the blade rod pipe 36 of a fishing rod, the inside rod pipe 38, and the former rod pipe 40, the decoration layer 4 is constituted and arranged so that a decorative effect (specifically optical operation effect of structure coloring) may change gradually.

[0044]The lightweight fishing rod excellent in the endurance which it continues at a long period of time, and can continue maintaining fixed appearance can be realized without producing problems which were produced in conventional technology, such as fading (colour fade-out), change of a color, exfoliation, according to such an arrangement configuration.

[0045]The sporting goods which can be formed are shown in drawing 12 as sporting goods concerning a 10th embodiment of this invention using two or more prepreg sheets 42.

[0046]As shown in drawing 12 (a), the prepreg sheet 42 is impregnated and formed in two or more fibers reinforced 44 which lengthened to the determined direction and were arranged with it in resin, and the decoration layer 4 (refer to drawing 1) is united with such a prepreg sheet 42.

[0047]The example in which the prepreg sheet 42 in which the decoration layer 4 was unified was formed on the main part 46 of sporting goods is shown in drawing 12 (b). In this case, in order to protect the prepreg sheet 42, it is preferred to form the protective layer 48 in the outside surface of the prepreg sheet 42.

[0048]Thus, if the decoration layer 4 is united with the prepreg sheet 42, it can become possible to arrange the decoration layer 4 simultaneously in a series of manufacturing processes of sporting goods, as a result, a manufacturing process can be simplified, and a manufacturing cost can be reduced.

[0049]

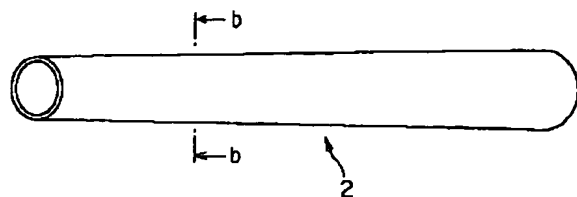
[Effect of the Invention]According to this invention, lightweight sporting goods excellent in the endurance which it continues at a long period of time, and can continue maintaining fixed appearance can be provided.

[Translation done.]

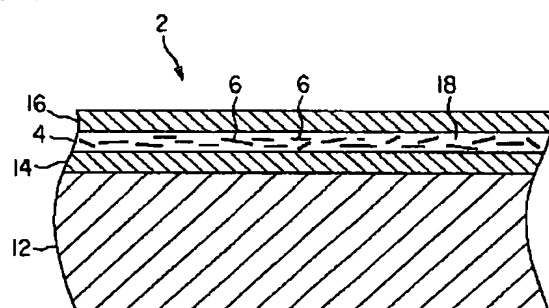
Drawing selection Drawing 1




(a)

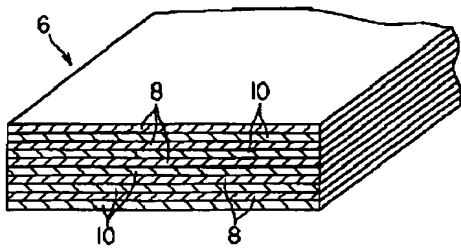


(b)



[Translation done.]

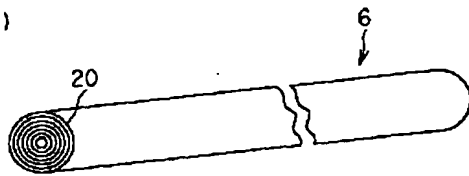
Drawing selection Drawing 2 



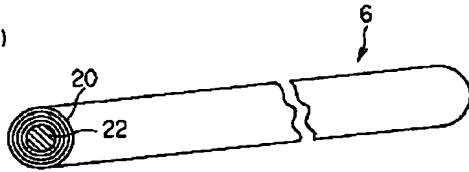
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Drawing selection Drawing 3

(a)



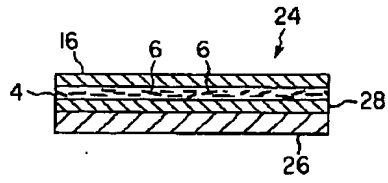
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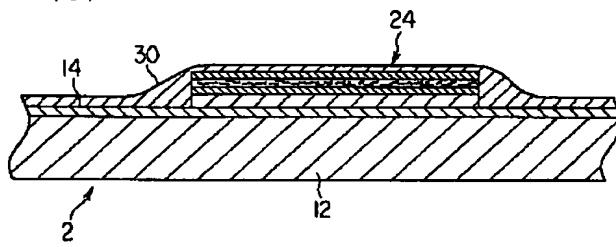
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Drawing selection Drawing 4

(a)

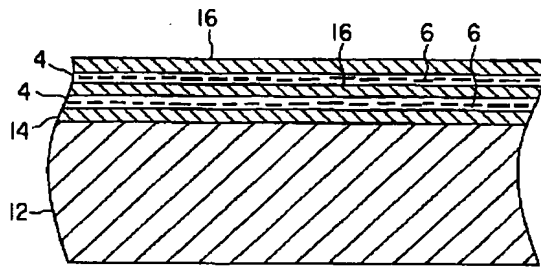


(b)



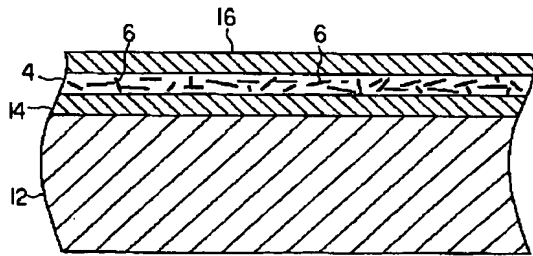
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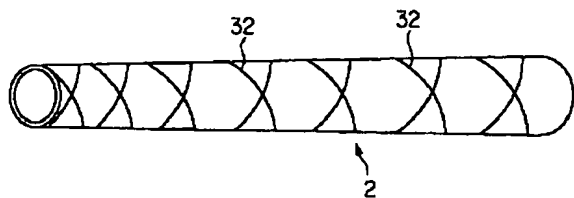
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Drawing selection Drawing 6



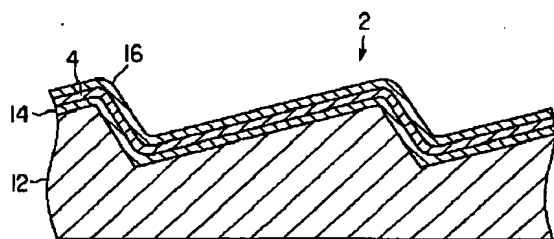
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Drawing selection Drawing 7



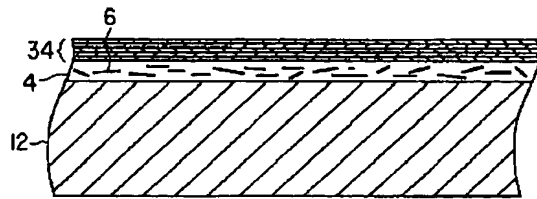
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Drawing selection Drawing 8



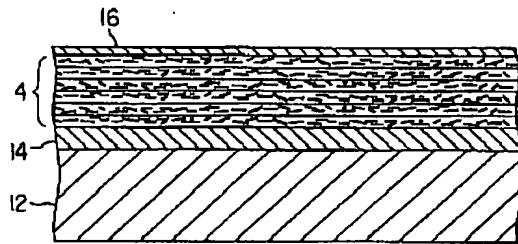
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Drawing selection Drawing 9



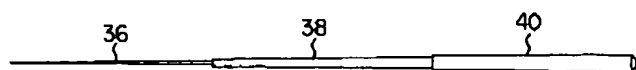
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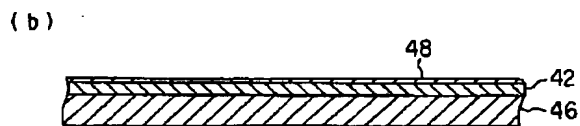
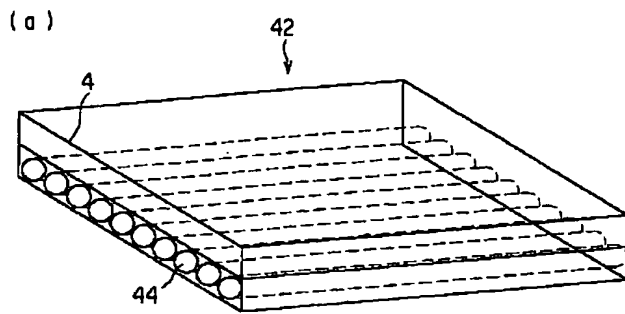
[Translation done.]

Drawing selection Drawing 11



[Translation done.]

Drawing selection Drawing 12



[Translation done.]